3.5: Higher–Order Derivatives

Definition.
The **second derivative** of f is

$$f''(x) = \frac{d}{dx}[f'(x)] = \lim_{h \to 0} \frac{f'(x+h) - f'(x)}{h}$$

We can repeatedly take the derivative of $f(x)$:

$$f'(x), f''(x), f'''(x), \ldots, f^{(n)}(x)$$

Example. Find all derivatives of

$$f(x) = x^5 - 7x^4 - 5x^3 - 2x^2 + 6x - 6$$

Example. Let $f(x) = x^{2/3}$. Find $f'''(x)$.

Example. Find the second derivative of $y = \left(2x^2 + 3\right)^{3/2}$

Example. The position function of a maglev train (in feet) is given by

$$s(t) = 4t^2, \qquad (0 \leq t \leq 30).$$

Find the velocity and the acceleration of the maglev train at time t

Example. Find $\dfrac{d^2y}{dx^2}$ if $x^2 + y^2 = 4$.